Instructions: 1. Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately. 2. Use Blue or Black ink to write and underline and pencil to draw diagrams.

PART - I

Note : i) Answer all the questions.

ii) Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer. $20 \times 1 = 20$

1) The rank of the unit matrix of order 'n' is

    a) n -1   b) n   c) n + 1   d) n^2

2) The system of equations 2x - y = 1, 3x + 2y = 12 has

    a) a unique solution   b) no solution   c) infinitely many solutions   d) none of these

3) $|A_{n \times n}| = 3$ |adj A| = 243 then the value n is

    a) 4   b) 5   c) 6   d) 7

4) If $T = \begin{matrix} A \\ B \end{matrix} \begin{bmatrix} \overset{A}{0.7} & \overset{B}{0.3} \\ 0.6 & x \end{bmatrix}$ is a transition Probability matrix, then the value of x is

    a) 0.2   b) 0.3   c) 0.4   d) 0.7

5) $\int \dfrac{e^x}{e^x + 1} dx$ is

    a) $\log \left| \dfrac{e^x}{e^x + 1} \right| + c$ b) $\log \left| \dfrac{e^x + 1}{e^x} \right| + c$ c) $\log |e^x| + c$ d) $\log |e^x + 1| + c$

6) Using the factorial representation of the gamma function, which of the following is the solution for the gamma function $\Gamma(n)$ when n = 8

    a) 5040   b) 5400   c) 4500   d) 5540

7) $\int_0^\infty e^{-5x} x^7 dx$ is

    a) $\dfrac{5!}{7^6}$ b) $\dfrac{7!}{5^8}$ c) $\dfrac{5!}{6^7}$ d) $\dfrac{7!}{(-5)^8}$

8) The value of $\int_2^3 f(5 - x)dx - \int_2^3 f(x)dx$ is

    a) 1   b) 0   c) -1   d) 5

9) The demand and supply functions are given by D(x) = 16 -x^2, S(x) = 2x^2 + 4 are under perfect competition, then the equilibrium price x is

    a) 2   b) 3   c) 4   d) 5

10) The producer's surplus when the supply function for a commodity is p = 3 + x and x_0 = 3 is

    a) $\dfrac{5}{2}$ units   b) $\dfrac{9}{2}$ units   c) $\dfrac{3}{2}$ units   d) $\dfrac{7}{2}$ units

11) The area bounded by the parabola $y^2 = 4x$ bounded by its latus rectum is

    a) $\dfrac{16}{3}$ Sq. units   b) $\dfrac{8}{3}$ Sq. units   c) $\dfrac{72}{3}$ Sq. units   d) $\dfrac{1}{3}$ Sq. units

12) If the marginal revenue MR $= 35 + 7x - 3x^2$, then the average revenue AR is

a) $35x + \dfrac{7x^2}{2} - x^3$ b) $35x + \dfrac{7x}{2} - x^2$ c) $35 + \dfrac{7x}{2} + x^2$ d) $35 + 7x + x^2$

13) The integrating factor of the differential equation $\dfrac{dx}{dy} + Px = Q$ is

a) $e^{\int Pdx}$ b) $e^{-\int Pdx}$ c) $\int Pdy$ d) $e^{\int Pdy}$

14) The differential equation formed by eliminating a and b from $y = ae^x + be^{-x}$

a) $\dfrac{d^2y}{dx^2} - y = 0$ b) $\dfrac{d^2y}{dx^2} - \dfrac{dy}{dx} = 0$ c) $\dfrac{d^2y}{dx^2} = 0$ d) $\dfrac{d^2y}{dx^2} - x = 0$

15) Which of the following is the homogeneous differential equations?
   a) $(3x - 5) dx = (4y-1) dy$ b) $xydx - (x^3 + y^3) dy = 0$
   c) $y^2dx + (x^2 - xy - y^2) dy = 0$ d) $(x^2 + y) dx = (y^2 + x) dy$

16) The Complementary function of $\dfrac{d^2y}{dx^2} - \dfrac{dy}{dx} = 0$ is

a) $A + Be^x$ b) $(A+B)e^x$ c) $(Ax+B)e^x$ d) $Ae^x + B$

17) If m and n are positive integers then $\Delta^m \Delta^n f(x) =$
a) $\Delta^{m+n} f(x)$ b) $\Delta^m f(x)$ c) $\Delta^n f(x)$ d) $\Delta^{m-n} f(x)$

18) $\Delta^2 y_0 =$
a) $y_2 - 2y_1 + y_0$ b) $y_2 - 2y_1 - y_0$ c) $y_2 + 2y_1 + y_0$ d) $y_2 + y_1 + 2y_0$

19) $\nabla f(a) =$
a) $f(a) + f(a - h)$ b) $f(a) - f(a + h)$ c) $f(a) - f(a - h)$ d) $f(a)$

20) If $f(x) = x^2 + 2x + 2$ and the interval of differencing is unity then $\Delta f(x)$
a) $2x - 3$ b) $2x + 3$ c) $x + 3$ d) $x - 3$

PART - II

Answer any 7 of the following. Q.No. 30 is compulsory: $7 \times 2 = 14$

21) Find the rank of Matrix $\begin{bmatrix} 1 & 4 \\ 2 & 8 \end{bmatrix}$

22) Parithi is either Sad (S) or happy (H) each day. He is happy in one day, he is sad on the next day by four times out of five. If he is sad on one day, he his happy on the next day by two times out of three. Over a long run, what are the chances that Parithi is happy on any given day?

23) Evaluate : $\displaystyle\int_{0}^{\pi 2} \cos^2 x\, dx$

24) Evaluate : $\int x\, e^x\, dx$

25) Find the area bounded by $y = 4x + 3$ with x axis between the lines $x = 1$ and $x = 4$.

26) If the marginal revenue function for a commodity is MR $= 2x^2 + 6x - 5$, Find the demand function.

27) Solve : $\sec^2x\,\tan y\, dx + \sec^2y\,\tan x\, dy = 0$

28) Find $\Delta^2 e^x$

29) Given $U_0 = 1$; $U_1 = 11$, $U_2 = 21$, $U_3 = 28$ and $U_4 = 29$ Find $\Delta^4 U_0$?

30) Solve : $y'' + y = 0$

PART - III

Answer any 7 of the following. Q.No. 40 is compulsory: $7 \times 3 = 21$

31) Evaluate : $\displaystyle\int_{0}^{\pi 2} \dfrac{\sin^7 x}{\sin^7 x + \cos^7 x}\, dx$

32) Elasticity of a function $\dfrac{Ey}{Ex}$ is given by $\dfrac{Ey}{Ex} = \dfrac{-7x}{(1 - 2x)(2 + 3x)}$. Find the function when x = 2, y = $^3/_8$

33) Find the differential equation corresponding to $y = ae^{4x} + be^{-x}$ where a, b are arbitrary constants.

34) Solve the differential equation $x \dfrac{dy}{dx} = x + y$

35) Show that the equations x + y = 5, 2x + y = 8 are consistent and solve them.

36) Evaluate : $\displaystyle\int_{-\pi 2}^{\pi 2} \cos x\, dx$

37) Find the area bounded by the line y = x, the x axis and the ordinates x = 1, x = 2.

38) Find the missing entry in the following table :

x	0	1	2	3	4
y	1	4	16	-	256

39) Using graphic method, find the value of y when x = 48 from the following data.

x	40	50	60	70
y	6.2	7.2	9.1	12

40) Solve the equations x + y + z = 6 ; 2x + 3y - z = 5 ; 6x - 2y - 3z + 7 = 0 by Cramer's rule.

PART - IV

Answer all the questions: $7 \times 5 = 35$

41) a) Show that the following system of equations have unique solution x + y + z = 3 ; x + 2y + 3z = 4 ; x + 4y + 9z = 6 by rank method.   **(OR)**

    b) Evaluate : $\displaystyle\int \dfrac{3x + 2}{(x - 2)(x - 3)}\, dx$

42) a) Find the consumer's surplus and producer's surplus for the demand function $P_d = 25 - 3x$ and supply function $P_s = 5 + 2x$ **(OR)**

    b) Solve the differential equation $y^2 dx + (xy + x^2)\, dy = 0$

43) a) Suppose that the quantity demanded $Q_d = 13 - 6p + 2\dfrac{dp}{dt} + \dfrac{d^2 p}{dt^2}$ and Quantity supplied $Q_s = -3 + 2p$ where p is the price. Find the equilibrium price for market clearance.   **(OR)**

    b) Using Lagrange's formula for interpolation, find the value of f(x) when x = 15.

x	4	7	10	17
f(x)	30	33	37	40

44) a) Solve : $3e^x$ tan y dx + $(1+e^x)$ $\sec^2 y$ dy = 0, y (0) = $\frac{\pi}{4}$ **(OR)**

b) Using integration find the area of the circle whose center is at the origin and the radius is a units.

45) a) Two types of soaps A and B are in the market. Their present market shares are 15% for A and 85% for B. Of those who bought A the previous year, 65% continue to buy it again while 35% switch over to B. Of those who bought B the previous year, 55% buy it again and 45% switch over to A. Find their market shares after one year and when is the equilibrium reached?   **(OR)**

b) Evaluate the integral as the limit of a sum : $\int_{1}^{2}(2x + 5)\,dx$

46) a) Using Newton's formula interpolation estimate the popultion for the year 1905 from the table.   **(OR)**

Year	1891	1901	1911	1921	1931
Population	98,752	1,32,285	1,68,076	1,95,670	2,46,050

b) Solve : $(3D^2 + D - 14)$ y = 4 - $13e^{-7x/3}$

47) a) The marginal cost C'(x) and marginal revenue R' (x) are givenn by $C'(x) = 50 + \frac{x}{50}$ and R'(x) = 60. The fixed cost is Rs. 200. Determine the maximum profit.   **(OR)**

b) Solve $\frac{dy}{dx}$ -3y cotx = sin2x given that y = 2 when $x = \frac{\pi}{2}$

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